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# GENERAL NOTES.

By Frank Schlesinger.

*The Constant of Aberration and the Solar Parallax.*—Recent series of observations, and the recomputation of earlier ones when the variation of latitude is taken into account, indicate that the value hitherto assigned to the constant of aberration is too small by about 0″.05. It is only a few years since the heads of four national observatories and several other prominent astronomers met at Paris to recommend a series of constants for uniform use in the ephemerides. The value of the aberration there adopted was 20″.47, replacing Struve's classic value of 20″.445; but now it seems nearly certain that the true value is above 20″.50, and probably 20″.52 would be the nearest estimate which our present knowledge permits us to make.*

So far as the requirements of the ephemerides are concerned, this modification of the value of the aberration would not be of great consequence; at most it corresponds to a change of a few hundredths of a second of arc in the "reduction to apparent place" of the stars. But when we consider the aberration in connection with the solar parallax, for example, a change of 0″.05 is a most important one. These two quantities (usually denoted by $k$ and $\pi$ respectively) are related to V, the velocity of light *in vacuo,* by the simple equation,

$$k \times \pi \times V = \text{a constant}$$

This constant is known with great precision, its probable error not exceeding one part in twenty thousand. The velocity of light is also known quite accurately,—compared with our knowledge of $k$ and of $\pi$,—its probable error not being greater than one part in two thousand. If we replace the constant and V in the above equation by their standard values, we get a relation between $k$ and $\pi$. The table below shows what values of the solar parallax would follow from various values of the aberration when we use this relation:—

| | | |
|---|---|---|
| 20″.445 | (Struve's value) . . . . . . . . . . | 8″.813 |
| 20 .47 | (Paris Conference) . . . . . . . . . | 8 .802 |
| 20 .52 | . . . . . . . . . . . . . . . . . | 8 .781 |

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* In *Astronomical Journal* No. 529, which has come to hand since this note was written, Dr. Chandler expresses the conviction that the "real value of this much disputed constant is likely to be found near or slightly above 20″.52."

Thus we see that the new value of the aberration implies a solar parallax about 0″.02 smaller than the usually accepted value of 8″.80. The latter is the result of so much labor and ingenuity that we should hardly expect it to be in error by so much, and it is therefore difficult to reconcile the results of observations on these two constants. Perhaps the completion of the *Eros* work and the more accurate knowledge of latitude variations that is now being accumulated may cause this difficulty to disappear.

In this connection there is another consideration which should be mentioned, though it is rather of philosophical than of practical interest. The equation which we have used to connect the aberration with the solar parallax and the velocity of light has never been rigorously demonstrated. It is equivalent to the explanation advanced by BRADLEY when he discovered the aberration nearly two centuries ago (1729). Now, in BRADLEY's time the corpuscular theory of light, resting on the great authority of NEWTON, was universally accepted; and if this theory were the true one, BRADLEY's explanation, and therefore our equation, would be rigorously demonstrated. We know now that light is a series of undulations in the ether, and that BRADLEY's explanation is no longer satisfactory. The difficulty arises from the unknown effect of the relative motion of Earth and ether. The reader is referred to the article on "Ether" by J. CLERK MAXWELL in the *Encyclopædia Britannica* (Ninth Edition, Vol. VIII, pp. 503 et seq.), and to Mr. SEABROKE's presidential address, printed in the Journal of the British Astronomical Association (Vol. XII, No. 1). This problem demands the use of the most refined mathematical analysis. It has been attacked by some strong men, but a complete solution is still wanting, and some unpalatable assumptions have been made with regard to the nature of the ether. While we need hardly fear a modification of our equation to a degree which present methods of observation could appreciate, it would certainly be a great satisfaction to know just how close an approximation it is and to have a complete theory of aberration.

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*The Difficulty of Determining the Constant of Aberration.*—The two constants that we have been discussing happen to be among the most difficult to determine among all those with which astronomy has to do. That this is true of the solar parallax is well known and understood, but the difficulty of determining the constant of aberration seems not to be so generally recognized. In considering the accuracy attainable for various astronomical phenomena, an obvious distinction presents itself between such as are *accumulative* in their character and those that are *periodic* or *stationary*. The former have a faculty of taking care of themselves, so to speak, with the lapse of time. For example, we can determine the annual precession of the equinoxes with any required degree of accuracy from two series of observations of the Sun and the stars, no matter how rough these may be, providing only that the interval of time between the two series be great enough. From a comparison of the observations of HIPPARCHUS and of TYCHO BRAHE we can get the annual precession with greater accuracy than attaches at present to many of the constants of astronomy. In this class with precession belong the proper motions of the stars, the rotation periods of the Sun and the planets, the periods of revolution (and therefore the relative distances) of planets around the Sun and of satellites around planets, the periods of variable and binary stars, and indeed all the periods in astronomy.

The other class of phenomena, those which receive no such powerful aid from time, are not susceptible of so great accuracy. These must depend upon the mere accumulation of observations or upon improvements in instruments and methods. The number of astronomical phenomena here included is practically without limit, but among them we may distinguish as especially difficult of determination those that have an annual period; the absolute parallax of a fixed star and the aberration are examples. Either of these depends essentially upon the accurate observation of the place of a star at two opposite seasons of the year. Now, it would be desirable that these observations should be made under nearly uniform conditions, but it is easy to see that changes of season make this impossible. Let us suppose, for example, that the apparent place of the star varies slightly with temperature; then our summer results will differ systematically from those of the winter, and error will creep into our determination of parallax or aberration. It is true that the effects of temperature are understood and may be approximately allowed for, but there are other effects that come with the changes of season which have not been reduced to law, or, worst of all, whose very existence is not suspected. No better example in this connection could be cited than Airy's experience with the *reflex zenith-tube* at Greenwich. A long and careful series of observations upon a certain star with this instrument yielded a value for the aberration which is certainly too small by nearly 0″.2. It was not until long after the instrument had been all but abandoned that the mystery was explained away by Chandler; the latitude variation (a phenomenon unsuspected by Airy or any of his contemporaries) has, among others, an annual term. These others are eliminated, so far as the aberration is concerned, in a series of observations extending over many years. But as the annual term did not vary to any great extent in this period, its effects were practically repeated from year to year, and were closely interwoven with those of the aberration itself, the periods of the two being identical. The annual term in the latitude variations certainly has its cause in the changes of season, and we may be sure that similar effects, though perhaps none so great, lie hidden in observations of our day and of the past, to be unearthed by astronomers of the future.

*Comet Notes.*—Four comets were discovered in 1902—

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| *a* by Brooks, | Geneva, N. Y., | on | April 14. |
| *b* by Perrine, | Lick Observatory, | on | August 31. |
| *c* by Grigg, | New Zealand, | on | July 23. |
| *d* by Giacobini, | Nice, | on | December 2. |

Comet *b* (Perrine) was for several weeks an easy naked-eye object, having attained at one time the brightness of a fourth-magnitude star. This comet is also interesting on account of its close approach to *Mercury* on November 30th, which may lead to a valuable determination of the planet's mass from its effect upon the comet's orbit. Luckily this comet has a well-defined nucleus, so that accurate measures of its position are possible.

Comet *c*, not an excessively faint object and well located for observations in both hemispheres, was nevertheless seen only by its discoverer, Mr. John Grigg, of Thames, New

Zealand. Mr. Grigg lacked the means for any but very rough measurements of the comet's position; so that the seemingly impossible thing has happened, in this day of many telescopes and of telegraph and cable, that we know practically nothing of the orbit of a comet which would probably have been visible for several weeks in telescopes of moderate size. No doubt it happens quite often that a comet visits the solar system without being detected at all; but if once seen, usually only a few hours elapse until a score of telescopes have been pointed to it, at observatories scattered around the Earth.

Nevertheless, comets are certainly accorded a better welcome now than two or three generations ago. Perhaps it would not be citing too extreme a case to mention Comet 1827 I as an example of how comets were observed at that day. The definitive orbit of this comet has been published in *Astronomische Nachrichten,* No. 3830, by Doctor Strömgren. The comet was discovered by Pons, of Florence, on December 26, 1826, and observations were made of it there on December 27th, 28th, 30th, and 31st, but on no other dates. Evidently the news of the discovery did not get abroad until the middle of January, for the next observation was made on January 17th, by Harding, at Göttingen; eight other observations were secured at Bremen and Kremsmünster by January 26th, the last date on which the comet was seen. But the inadequacy of the data for computing an orbit does not appear until the character of the observations is examined. The Florence observations seem to be inferior to what one might make with the naked eye upon a sufficiently bright comet; the residuals obtained by comparison with a preliminary orbit average over ten minutes of arc, even after rejecting one observation whose residual is 46′. The single Göttingen place is hardly better, the residual in R. A. being 5′.8, and in declination 3′.6. The four Kremsmünster observations in their original form were very wild, but they were much improved by Dr. Strömgren's new reduction of them. The four observations at Bremen were made by Olbers, and are, of course, good for that day, but unfortunately they embrace a period of only four days. Thus the orbit of this comet rests on the eight observations made at Bremen and Kremsmünster, and these were all made between January 18th and January 26th.

*Nova Persei.*—The great usefulness of the Harvard photographs has again been shown by an important discovery with regard to the early history of *Nova Persei.* Father ZWACK, of the Georgetown College Observatory, some time ago called Professor PICKERING's attention to a faint star on one of the early Harvard plates, at or very near the position now occupied by *Nova Persei.* Careful measurements show that the two objects are in all probability identical, and furthermore it appears that the faint star was a variable, with a range of about one magnitude and a maximum brightness of the thirteenth magnitude. One other *Nova,* that of 1866 in *Corona Borealis,* is known to have existed before its outburst, having been recorded in the Bonn *Durchmusterung.*

This discovery with regard to *Nova Persei* tends still further to do away with the distinction between variable and temporary stars. Indeed, if it should be found that *Nova Persei* will again become variable there is little distinction, except in degree, between its fluctuations and those of *Mira Ceti,* for example.

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It was stated in General Notes, No. 86 of these *Publications,* that *Eros* is the only exception to the rule that minor planets should have feminine names. Professor TURNER points out in *Observatory* that another exception is presented by planet (342), which is named *Endymion.*

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Laws Observatory, of Missouri University, has adopted the method of publication by Bulletins, and No. 1 has been distributed. This is entitled "Observations and Elements of Comet *b* 1902 (PERRINE)," by Professor F. H. SEARES. The observations are 30 in number, and extend from September 4 to October 28, 1902. Upon these is based a computation of the orbit of the comet by an adaptation of LEUSCHNER's recent method.

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*Herschel's Nebulous Regions.*—The elder HERSCHEL noted during his sweeps 52 regions "affected with nebulosity," and published in the *Philosophical Transactions* brief descriptions of them, with their approximate positions and dimensions. Doctor ISAAC ROBERTS has recently photographed all these regions with a 20-inch reflector and exposures of 90 minutes each. These should show, according to the estimate of Dr. ROBERTS, stars as faint as the sixteenth or seventeenth magnitude, but the result is reached that the nebulosity of only four of the regions is confirmed. This result is all the more surprising becausing HERSCHEL'S notes do not indicate that these four regions are more affected than some of the others. As it is hard to understand how HERSCHEL could be so greatly mistaken, and still more difficult to see how these photographs can be in error, a repetition elsewhere of Dr. ROBERTS'S survey would be most valuable.

Jan. 15, 1903.